Report Information
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DIALOG

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A video eye tracking system based on a statistical algorithm.

Accession number & update

      0004839678 20070101.

Conference information

      Proceedings of 36th Midwest Symposium on Circuits and Systems,
Detroit, MI, USA, 16–18 Aug. 1993.
Sponsor(s): Wayne State Univ; IEEE Circuits & Syst. Soc.

Source

      Proceedings of the 36th Midwest Symposium on Circuits and Systems (Cat. No.93CH3381–1), 1993, vol.1, p. 438–41 vol.1, 7 refs, pp. 2 vol. xxxv+1565, ISBN: 0–7803–1760–2. Publisher: IEEE, New York, NY, USA.

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Abstract

      Presents the design and analysis of an algorithm which determines the yaw, pitch, roll and **pupil** diameter states of an **eye** viewed with a standard video camera. A maximum likelihood estimation technique tracks the location and size of the **pupil** in a video image to find horizontal and vertical **eye** position. Simulations and analyses show that the noiseless measuring resolution of horizontal and vertical movements is less than 0.05 pixel on an image. Eased on accurate measurements of **pupil** position, counterroll movements are calculated using cross correlations between one dimensional templates which consist of equidistant pixels on a partial annulus overlying the iris and **concentric** with the **pupil** center. Another advantage of the algorithm is a robustness with respect to intrusions of droopy eyelids and random light reflections. Analysis shows that eyelids which cover **pupils** by less than a third of **pupil** radius do nor cause a bias in **pupil** position estimates. Light reflections on the **pupil** boundary have a minimal effect on estimate bias, while light reflections embedded inside the **pupil** have a lesser effect. The speed of image analysis (about 10 frames per second on Macintosh IIfx computer), the robustness for eyelid cover and random light reflections, and the ability to track 4 dimensional **eye** movement (horizontal, vertical, counterroll movement and **pupil** size) are major characteristics of the algorithm.

Descriptors

      BIOLOGICAL–TECHNIQUES; BIOMECHANICS; **EYE;** MAXIMUM–LIKELIHOOD– ESTIMATION; TELEVISION–APPLICATIONS.

Classification codes

      A8780 Biophysical–instrumentation–and–techniques*;
A8732 Physiological–optics–vision;
A8745D Physics–of–body–movements.

Keywords

      video–eye–tracking–system; statistical–algorithm; maximum–likelihood– estimation–technique; **pupil–**position; counterroll–movements; equidistant–pixels; partial–annulus; iris; **pupil–**center; light– reflections; Macintosh–IIfx–computer; droopy–eyelids; random–light– reflections.

Treatment codes

      T Theoretical–or–mathematical.

Language

      English.

Publication type

      Conference–paper.

Availability

      CCCC: CH3381–1/93/$01.00.

Digital object identifier

      10.1109/MWSCAS.1993.342994.

Publication year

1993.

Publication date

19930000.

Edition

1994050.

Copyright statement

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Search Strategy

No.	Database	Search term	Info added since	Results
1	INZZ	pupil$4 AND eye$1	unrestricted	1816
2	INZZ	concentric$4	unrestricted	14288
3	INZZ	1 AND 2	unrestricted	13

Saved: 19–Aug–2008 18:49:36 MEST